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Record of Decision:

ABERDEEN PROVING GROUND (MICHAELSVILLE LANDFILL)
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06/30/1992

Text:

RECORD OF DECISION MICHAELSVILLE LANDFILL Operable Unit One U.S. Army Aberdeen Proving Ground, Maryland DECLARATION

SITE NAME AND LOCATION

Michaelsville Landfill
Aberdeen Area
Aberdeen Proving Ground, Maryland

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Michaelsville Landfill site. The selected remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

The Environmental Protection Agency and the State of Maryland concur on the Selected Remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This operable unit is the first of two operable units for the site. This operable unit involves capping the landfill to prevent further precipitation infiltration and subsequent leachate migration to the ground water. The second operable unit will address other media to determine the need, if any, of further remediation at the site.

The major components of the Selected Remedy include:

- Installing a new, multilayered cap in accordance with MDE requirements for sanitary landfill, using a geosynthetic membrane. The design features of this system include a minimum 2 feet of compacted semipervious earthen material over the existing landfill cover; a geosynthetic membrane (minimum thickness 20 mil) over the earthen material; 12 inches of sand drainage material embedded with perforated drainage pipes over the membrane; and a final earthen cover (minimum 2 feet thick) with a 4 percent minimum slope and vegetative stabilization;

- Installing surface water controls to accommodate seasonal precipitation; and

- Installing a methane gas venting system within the cap system.

STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment and is cost-effective. It also complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. The size of the landfill, excessive costs associated with the excavation alternatives, and the difficulties of implementing the excavation alternatives preclude a remedy in which contaminants could be excavated and treated effectively. The Selected Remedy is consistent with the Superfund program policy of containment, rather than treatment, for wastes that do not represent a principal threat at the site and are not highly toxicor mobile in the environment.

Because the Selected Remedy will result in hazardous substances remaining on-site above health-based levels, a review under Section 121(c) of CERCLA, 42 U.S.C. 9621(c), will be conducted within five years after the commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

RECORD OF DECISION

MICHAELSVILLE LANDFILL

Operable Unit One

U.S. Army Aberdeen Proving Ground, Maryland

DECISION SUMMARY

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DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

As shown in Figure 1, Aberdeen Proving Ground (APG) is located along the Chesapeake Bay in Harford County, Maryland, approximately 15 miles northeast of the city of Baltimore. The Michaelsville Landfill (MLF) is located in the northern portion of APG in the Aberdeen Area (AA) between Michaelsville Road and Trench Warfare Road.

General

MLF is located in the north-central portion of APG-AA (Figure 2). Figure 3 provides an illustration of MLF. MLF is an approximately 20-acre,unlined municipal-type landfill characterized by two small, mounded areas, one near the northeast end of the landfill and the second near the center of the landfill (Figure 3). Elevations on the landfill range between 28 and 46 feet above mean sea level (msl). The waste in the landfill is buried to a depth of approximately 10 feet below the original ground surface elevation and is mounded to a height approximately 16 feet above the original ground surface elevation. Two low-lying areas and a pond are located adjacent to the southwestern edge of the landfill. The northeastern end of MLF (approximately 5 acres) is covered with grass; the remainder of the landfill is covered with small trees, shrubs, and tall grass. Many erosional rills and gullies cut the southern end of the landfill, and seeps occur around the perimeter of the landfill during rainy periods. Several drainage ditches around the landfill receive runoff from these seeps and other nearby areas (Figure 3).

MLF Geology

The general stratigraphy at APG-AA is based on an exploratory boring (777 feet deep) on Spesutie Island (Figure 2). The upper 85 feet of sediment, which is a medium to coarse sand overlying a brown silt that overlies fine to coarse sand, gravel, and some cobbles, has been defined as the Talbot Formation. The Talbot unconformably overlies the Potomac Group at an elevation of -73 feet mean sea level (msl). A break between the Patapsco Formation and the underlying Arundel Formation was estimated to be at an elevation of -403 feet msl. The Arundel Formation and the underlying Patuxent Formation were not differentiated. Bedrock was encountered at an elevation of -748 feet msl.

A silty clay layer ranging in thickness from 5 to 16 feet is consistently found over the surface of the MLF site (WES, 1990). The landfill waste material is reported to be within the silty clay, extending to an average depth of 6 feet below original grade. Underlying the silty clay layer are 20 to 30 feet of depositional layers of gravel and sand with clay lenses in some areas. This gravel and sand layer is considered the uppermost aquifer and varies from a water table aquifer to a confined aquifer. Underlying the gravel and sand layer are 50 to 65 feet of interbedded clays, silts, and sands that act together as an aquitard. In the eastern portion of the site, there are two sand layers within the interbedded clays, silts, and sands, which are possible minor aquifers. Underlying the interbedded clays, silts and sands is the lower sand aquifer, an approximately 30-foot-thick, fine-grained, carbonaceous sand layer. Underlying the sand layer is an approximately 10-foot-thick layer of interlaminated brown, organic clays, silts, and fine-grained sands. The base of the aquifer unit beneath MLF is defined by a consistent, hard, waxy, clay aquiclude layer found at depths of -85 feet msl in the northern part of the site and -100 feet msl in the southern part.

MLF Surface Water

MLF is not within the 100-year flood area. The nearest 100-year flood area is approximately 1 mile east of MLF along Woodcrest Creek (FEMA, 1983). Multiple erosional rills and gullies cut the southern edge of the landfill and several seeps are located around the perimeter. Flow from the seeps is intermittent, depending on rainfall. Flow from seeps generally drains into nearby drainage ditches (Figure 3). One of the drainage ditches at MLF flows into the northeastern edge of the property and south along MLF until it merges with the drainage ditch which intercepts seeps from the southern edge of the landfill (ICF, 1991). Low areas around MLF become temporarily inundated during heavy rainfalls. Two low-lying areas and a pond are located adjacent to the southwest portion of the landfill. MLF is located in the Romney Creek watershed (ICF, 1991).

MLF Ground Water

Two aquifers, identified as the uppermost aquifer and the lower aquifer have been studied at MLF (WES, 1990). The uppermost aquifer is located beneath the surficial silty clay layer and has a base 30 to 40 feet deep on the aquitard of interbedded clays, silts and sands. Ground water elevation in the uppermost aquifer ranges from 20 to 25 feet msl, which is approximately 5 to 10 feet below the ground surface surrounding MLF.

The lower aquifer is beneath the aquitard and above the consistent clay found at -85 to -100 feet msl. Borings are extending into this clay for 20 to 65 feet. The potentiometric level in the lower aquifer is consistently two to three feet below the ground water elevations of the uppermost aquifer.

Regional ground water movement is generally southeast towards the Chesapeake Bay. Water elevations from the shallow WES wells were used to contour the water table in 1988 and 1989. Although the predominant flow direction in the upper aquifer was to the Trench Warfare Road side of the landfill, several flow reversals were noted and it appears that the landfill and surrounding recharge areas may be locally affecting flow. The major component of flow in the lower confined aquifer is to the south-southwest (WES, 1990).

The City of Aberdeen production wells northwest of MLF utilize the uppermost aquifer and the Harford County production wells southwest of MLF utilize both the uppermost and lower aquifer. The City of Aberdeen production wells are upgradient of MLF ground water flow and the Harford County production wells are crossgradient from MLF ground water flow.

MLF Climatology

Due to the proximity of two large bodies of water, the Chesapeake Bay and the Atlantic Ocean, the climate in the APG area tends to be moderate as compared to the inland areas (ESE, 1981). The average annual temperature is 54.5 degrees Fahrenheit (F), with an average relative humidity of 73.8 percent. Precipitation averaged 44.8 inches (in.) per year over the last 21 years, with the maximum rain fall occurring in the summer and the minimum during the winter (WES, 1990). Precipitation as snowfall averages 12 in. per year (Sisson, 1985). Prevailing winds average 6.8 knots (Sisson, 1985) in a northwest to north-northwest direction in the winter months and a south to south-southwest direction in the summer months (ESE, 1981

MLF Land Use

MLF has been closed since the December of 1980. APG-AA is a fenced, controlled area and access to MLF is restricted. The landfill itself is not fenced, and there are no control measures to prevent access once personnel are within the controlled area.

The landfill itself had been capped with a 0 to 2-foot thick layer of compacted earthen material. Ground water monitoring wells are located around the landfill (as can be seen in Figure 4). A series of gas vents has also been installed. In addition, a seep drainage system serves to collect leachate seepage and contain it for removal off-site. These features will be discussed in more detail in the following section.

The main industrial sector of APG-AA is approximately 3,300 feet north of MLF. Several operations are situated around the landfill. A large firing range is located immediately south and east of the landfill. Firing is parallel to the landfill, and observation towers are located on Trench Warfare Road near each end of the landfill. An ammunition receiving and shipping building is located approximately 500 feet west of the landfill; most of the landfill is located within the 1,800-foot safety clearance range of the ammunition receiving and shipping building. An unused concrete observation tower is located approximately 150 feet northeast of the landfill, and a pistol range is located approximately 1,500 feet north of the landfill (ICF, 1991). The Defense Reutilization and Marketing Office (DRMO) scrap metal yard is located approximately 1,300 feet northeast of the landfill (as can be seen in Figure 2).

APG barracks are located approximately 1 mile north of the landfill, and on-post family housing is located about 2 miles north of the landfill. The City of Aberdeen is approximately 4 miles north of the landfill, and the City of Perryman is approximately 1.75 miles west of the landfill. All of these residential areas are outside of the fenced, controlled area of the AA (ICF, 1991).

MLF Flora and Fauna

Wetlands habitat characteristics of MLF and the surrounding area are shown in Figure 5. The northern part of the site is covered with grass. The southern portion is covered with grass, shrubs, and small trees one to ten feet high. A pond is located near the southwestern part of the landfill. A drainage ditch runs along the southeastern edge of the landfill and connects with another drainage ditch, which intercepts the seeps from the southern edge of the landfill (Figure 3). Romney Creek is located south and east of the site, and a wetland area is located around Romney Creek (ICF, 1991).

Terrestrial wildlife in the area of the landfill probably includes song birds, rabbits, and field mice. In addition, the bald eagle, an endangered species known to be present at APG, could spend some time in the landfill area. Small shorebirds may frequent the ditch and the pond. Raccoons may also use these areas. Aquatic invertebrates and amphibians may be present in the drainage ditch along the southern edge of the landfill and in the pond. Fish may also be present in the ditch, but significant fish populations are not expected to be present. Water flow in the seeps is intermittent and dependent on rainfall; thus, the diversity and abundance of aquatic life in the seeps is expected to be limited (ICF, 1991).

As noted in Figure 5, areas in the northern corner of the landfill and adjacent to the southwestern corner of the landfill are considered wetlands. The combined areal extent of these locations is estimated to be 2.5 acres.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

History of Site Activities

Operations at MLF began about 1970 and continued until its closure in 1980. Previous studies of the landfill operations indicate that trench and fill methods were used to dispose of wastes in the landfill. Wastes were covered with soil and compacted with a bulldozer. The majority of materials reportedly disposed of in MLF were domestic trash and trash from nonindustrial sources at APG. Other materials that reportedly may have been disposed of in limited quantities include solvents, waste motor oils, polychlorinated biphenyl (PCB) transformer oils, wastewater treatment sludges, pesticides containing thallium, insecticides containing selenium, and rodenticides containing antimony.

History of Investigations/Remedial Actions

After MLF was closed in 1980, the landfill cap's condition was inspected by the Harford County Department of Health in 1981, the State of Maryland Department of Health and Mental Hygiene (DHMH) in 1983, the U.S. Army Environmental Hygiene Agency (AEHA) in 1985, the U.S. Army Corps of Engineers Waterways Experiment Station (WES) in 1987 through 1990, and the Maryland Department of the Environment (MDE) in 1991.

The 1981 inspection of MLF by the Harford County Department of Health recommended that the landfill be capped with a minimum of 2 feet of relatively impermeable material and covered with topsoil. In 1983, the State of Maryland DHMH inspected the landfill after some work had been accomplished at the site. The DHMH representative advised APG personnel that the cover was satisfactory with the exception of two "leachate outbreaks" that APG personnel were instructed to repair. In 1985, AEHA personnel observed the landfill and noted that the "cap and cover do not appear to be functioning adequately." AEHA recommended that an impervious cap be placed on the landfill with adequate compaction and sloping.

The MLF investigation by WES from 1987 through 1990 included the installation of ground water monitoring wells and the collection and analysis of ground water, surface water, seepage water, soil, and air samples. The draft Hydrogeologic Assessment (HGA) report prepared by WES concluded that, according to analysis of ground water from the monitoring wells surrounding MLF, the landfill is contributing chemicals to the uppermost aquifer (WES, 1990). This reportedly occurs primarily along the southeast side of the landfill, on the ends of the landfill, and immediately northwest of the landfill. Parameters detected in the ground water included a number of organic and inorganic contaminants which were evaluated by ICF (1991) in the Preliminary Risk Assessment (PRA) and which will be discussed in subsequent sections.

MDE representatives visited MLF in January, March, and April 1991. During these site visits, MDE representatives observed "leachate outbreaks" at several locations on MLF. Observation reports written by MDE personnel during these site visits suggested that capping the landfill could prevent these leachate outbreaks from continuing.

In June and July 1991, under the Installation Restoration Program, a removal action was conducted at MLF involving the installation of a leachate collection system to control and collect leachate. The collection system consists of a network of subsurface drains that extend to identified seep areas and collect leachate for transfer to sumps along the east side of the landfill. The leachate is automatically pumped from the sumps to nearby holding tanks. The holding tanks are periodically emptied and the leachate disposed through APG's sewage treatment plant.

Enforcement Activities

In April 1985, the U.S. Environmental Protection Agency (EPA) published a Federal Register notice which proposed MLF for inclusion on the National Priorities List (NPL). MLF was listed on the NPL on October 4, 1989. Pursuant to Section 120 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9620, the U.S. Army and EPA signed a Federal Facility Agreement (FFA) in March 1990 which provides for the oversight and enforcement of environmental investigations and remedial actions at selected APG study areas. MLF is one of the APG study areas specified in the FFA.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The HGA (WES, 1990), Focused Feasibility Study (FFS) (Dames & Moore, 1991a), Proposed Remedial Action Plan (Dames & Moore, 1992), and background documentation for MLF were released to the public for comment on March 18, 1992. These documents were made available to the public in the local information and administrative record repository at the Aberdeen and Edgewood Public Libraries. The notice of availability of these documents was published in the March 18, 1992 issue of the Aegis and The Sun newspapers, and in the April 5, 1992 issue of the Harford County Sun. A public comment period on the documents was held from March 18, 1992 to May 4, 1992. Additionally, a public meeting was held on April 9, 1992 at the Aberdeen Area Chapel, APG. At this meeting, representatives from the U.S. Army, EPA, and the MDE answered questions about MLF and the cap and cover system remedial alternatives underconsideration. Responses to comments received during this period are included in the Responsiveness Summary, which is part of this Record of Decision (ROD). The Responsiveness Summary is based on oral and written comments received during the public comment period. The above actions satisfy the requirements of Sections 113(k) and 117 of CERCLA, 42 U.S.C. 9613(k) and 9617. The decision for this site is based on the administrative record.

IV. SCOPE AND ROLE OF OPERABLE UNIT

The Army has organized the work at MLF into two operable units (OUs) which are as follows:

- OU One: Source of Contamination.
- OU Two: Ground water contamination.

The first OU authorized by this ROD addresses MLF's source of contamination. Infiltration of precipitation could result in migration of contaminants to the ground water and thus the landfill poses a potential risk to human health and the environment. The landfill poses a potential risk to human health and the environment because of the potential for precipitation to infiltrate the waste and mobilize contaminants which could migrate to the ground water, posing a potential risk due to ingestion of the ground water. In addition, the landfill presents a potential for dermal contact with waste materials and inhalation of airborne contaminants. The purpose of this response is to minimize leachate flow to the ground water and to prevent current or future exposure to the waste material via dermal contact or inhalation of airborne contaminants.

The Army has already begun to address the second OU through the conduct of a Remedial Investigation and Feasibility Study (RI/FS) of the sediment, surface water and ground water at and near MLF (WES, 1991). The RI/FS for the second operable unit will continue with the installation of additional wells and sampling as described in the RI/FS Work Plan (WES, 1991) if theWork Plan is approved by EPA and concurred by MDE. The RI/FS will determine if remedial action is necessary to further mitigate the potential spread of contaminants from the landfill.

V. SUMMARY OF SITE CHARACTERISTICS

The source of contamination at MLF is the waste in the landfill itself. By far the majority of materials placed in MLF was domestic trash and trash from non-industrial operations at APG. The remaining portion of the waste included sludges from the waste water treatment plant, pesticide containers, rabbit droppings, swimming pool paint, old asbestos shingles, solvents, waste motor oils, grease, and PCB transformer oils (WES, 1990). In addition, pesticides containing thallium, insecticides containing selenium, and rodenticides containing antimony may have been placed in MLF in limited quantities.

MLF Soil

In October 1989, two surface soil samples were collected by WES from the top of the landfill as a part of the May 1990 draft HGA (WES, 1990). Because the landfill is covered with what is presumed to be clean fill, these samples were not believed to be representative of landfill contamination (ICF, 1991). Two other soil samples were collected by WES approximately 700 feet east of the landfill to serve as "background" samples. Although the two background samples help to characterize levels of chemicals in nearby areas (out of the fill area), they may not be representative of "natural" background because they were collected from sites located between the DRMO scrap metal yard and the landfill, an area that would not be expected to be unaffected by human activities (ICF, 1991). Soil samples were analyzed for volatile organic compounds, semivolatile organic compounds, pesticides, PCBs, and inorganic chemicals.

Constituents detected in MLF surface soil are shown in Table 1. Organic chemicals detected were acetone, methylene chloride, and several pesticides. With the exception of acetone, all organic chemicals detected in these samples were detected in the background samples at similar levels. This may mean that their presence in cover soils is indicative of general area contamination (perhaps from pesticide usage) that may or may not be related to landfill operations. Methylene chloride, which was also present in the soil blank, is a common laboratory contaminant, and therefore may not actually be present in the landfill cover soils. Acetone, also a common laboratory contaminant, was not present in the soil blanks (WES, 1990).

Of the inorganic chemicals detected in landfill soils, the maximum concentrations of chromium, copper, and zinc were present at levels only slightly above the maximum concentration detected in background samples. The potential routes of exposure to contaminants found in soils at MLF include dermal contact, inhalation of airborne dusts, leaching of soil

contamination to ground water during precipitation events, and transport of soil contamination by runoff to surface water. Because the site is located in a secure military installation to which access is limited, the likelihood of exposure through dermal contact is relatively low.

MLF Ground Water

A total of 33 ground water wells have been installed around MLF during previous investigations, including eight installed by USACE and 25 installed by WES. The eight USACE wells were sampled in January and September 1988, 24 of 25 WES wells were sampled in September 1988, 22 of 25 WES wells were sampled in December 1989, and all 25 WES wells were sampled in April 1989. Shallow well WES-M-15 was also sampled on June 2, 1988 (WES, 1990). Figure 5 provides the locations of all wells at MLF.

Ground water samples were analyzed for volatile organic compounds,semi-volatile organic compounds, pesticides, PCBs, and dissolved inorganic chemicals. In addition, the ground water sample collected from shallow well WESM-15 on June 2, 1988, was analyzed for explosive compounds (WES, 1990).

The chemicals detected in these sampling rounds from the shallow and deep ground water wells at MLF are shown in Tables 2 and 3, respectively. Thirty organic chemicals were detected in shallow ground water (WES, 1990). About half of these chemicals were, however, detected in fewer than 10 percent of the samples and at low concentrations. The predominant organic groups present in this ground water were pesticides, phthalate esters, and chlorinated aliphatics. Methylene chloride was the most frequently detected chemical. PCBs were also detected relatively frequently but at very low levels (less than 1 microgram per liter (ug/L)). It should be noted that several phthalates, many pesticides, PCBs (Araclor-1254), and ammonia nitrogen were also detected in blank samples during these sampling events (except for January 1988, when no blank samples were collected; WES, 1990). Deep ground water showed fewer organic chemicals, but a similar array at generally lower concentrations. Acetone was an exception because it was present at much higher concentrations in deep ground water; it was detected in one of 28 samples in shallow ground water at a concentration of 70 ug/L and in two of five samples at a maximum concentration of 2,310 ug/L in deep ground water (WES, 1990).

Several inorganic chemicals were identified as being potentially elevated above background levels in both shallow and deep ground water. However, no site-specific or regional ground water background data were available with which to compare site levels. Several inorganic chemicals were also detected in blank samples (WES, 1990).

With respect to spatial distribution of ground water contamination, in general, the highest constituent concentrations in ground water are south and east of MLF (ICF, 1991). Potential routes of exposure to humans include ingestion of and dermal contact with contaminated ground water. Potential routes of environmental contamination include discharge of contaminated ground water to surface water bodies. As is discussed in the following section, the likelihood of a current use of the ground water below MLF for human consumption is low, and therefore exposure by dermal contact and ingestion is unlikely. However, a future potential use of ground water as a drinking water source can not be precluded and exposure by dermal contact, ingestion or inhalation could still be possible.

MLF Seeps

Multiple erosional rills and gullies cut the southern edge of the landfill and several seeps are located around the perimeter of the landfill. Flow from the seeps is intermittent, depending on rainfall. Seeps in the southern portion of the landfill drain into a nearby drainage ditch (discussed below). Ten samples were collected by WES from seeps: May 1988--one sample, September 1988--one sample, April 1989--four samples, and October 1989--four samples (WES, 1990). Seep samples were analyzed for volatile organic compounds, semivolatile organic compounds, pesticides, PCBs, and inorganic chemicals.

The chemicals detected in seeps from MLF are shown in Table 4. A relatively large number of organic chemicals were detected in seep water, although generally infrequently. These chemicals include volatiles such as acetone, methylene chloride, and vinyl chloride, as well as phthalates, pesticides, and PCBs. Blank data available for the October 1989 sampling round included detections of methylene chloride, butyl benzylphthalate, di-n-octyl phthalate, bis (2-ethylhexyl) phthalate, and PCBs. Although several inorganicchemicals were identified as being potentially elevated above background levels, no appropriate background data were available with which to compare site seep levels (ICF, 1991). In lieu of more appropriate data to characterize levels of inorganics seeping out of natural soils in the area, ICF used national ground water data. This, however, introduces considerable uncertainty into this determination. In addition, background ground water concentrations are dissolved concentrations, whereas seep concentrations are total concentrations.

Potential routes of human exposure from seeps include ingestion of or dermal contact with seeps, or ingestion of wildlife that has ingested seep material. Potential routes of environmental exposure include movement of seeps to surface water bodies, infiltration of seep material to ground water, and volatilization of seep components to the air. Because MLF is

located in a secure military installation with limited access, ingestion of or dermal contact with seeps is unlikely. Furthermore, because hunting is not allowed in the vicinity of the site, the likelihood of ingesting wildlife which has ingested seep material is minimal.

MLF Surface Water

A drainage ditch, which receives runoff from the DRMO scrap metal yard area, flows into the northeastern edge of the landfill property and then south adjacent to the landfill (Figure 3). Two low-lying areas and a pond are located adjacent to the southwestern portion of the landfill. One surface water sample was collected by WES from each of the following locations: upgradient approximately 500 feet east of the site in the drainage ditch that flows south of the landfill, downgradient near the southwestern corner of the landfill in the same drainage ditch, and the small pond near the southwestern corner of the landfill (WES, 1990). Surface water samples were analyzed for volatile organic compounds, semivolatile organic compounds, pesticides, PCBs, and inorganic chemicals. No associated blank samples were collected.

The chemicals detected in surface water are shown in Table 5. Low levels of pesticides (all benzene hexachloride (BHC) isomers) as well as bis(2-ethylhexyl) phthalate (a common laboratory contaminant) were detected in site samples. None of these chemicals were detected in the upgradient sample (although the detection limits were probably very close to the detected values on-site), except beta-BHC, which was detected at a higher, but still low, concentration in the upgradient sample than in the site sample. All organic chemicals detected in surface water were selected as chemicals of potential concern, although, based on the above discussion, there is some question as to their association with landfill activities. A comparison of downstream surface water concentrations of inorganics with those detected in the upstream sample showed that iron, lead, and nitrate exceeded upstream concentrations by a factor of two (ICF, 1991).

Potential routes of human exposure from surface water includes ingestion of or dermal contact with contaminated surface water or ingestion of wildlife which has ingested contaminated surface water. Because MLF is located in a secure military installation with limited access, ingestion of or dermal contact with contaminated surface water is unlikely. Furthermore, because hunting is not allowed in the vicinity of the site, the likelihood of ingesting wildlife which has ingested contaminated surface water is minimal.

Air

A total of 12 gas monitoring wells (G-1 through G-12) were installed in and around the landfill perimeter by WES in January 1989 (WES, 1990). The locations of these gas monitoring wells are illustrated in Figure 4. Sampleswere collected from these wells in February, March, and April 1989. The analytical results for these three rounds of sampling are provided in Tables 6, 7, and 8, respectively. The highest methane concentrations have been detected in wells north and northwest of the landfill (WES, 1990).

In addition to the sampling and analysis of the gas monitoring wells, the headspace of each ground water monitoring well was monitored for methane and volatile organic gases prior to sampling during the HGA (WES, 1990). The highest volatile organic headspace reading was 2 parts per million (ppm) and the highest methane headspace reading was 45 percent. Methane levels of 90 to 5,971 ppm were also found in the headspace of five deep monitoring wells sampled by WES in 1988 (WES, 1990).

Ambient air monitoring surveys were also conducted in the area of MLF by WES in April 1989, using an organic vapor analyzer (OVA), and in March 1990 using an HNU photoionization detector. WES (1990) reported that "no gases" were detected in either survey. ICF (1991) noted that this kind of air data is only useful for a qualitative assessment.

Potential routes of exposure to air contaminants include direct inhalation of contaminants, migration of landfill gases to buildings and subsequent inhalation of materials or explosion due to gas concentrations, and dispersion of airborne dusts with subsequent deposition of contaminants on the ground surface.

VI. SUMMARY OF SITE RISKS

In January 1991, a Preliminary Risk Assessment (PRA) report was drafted for the MLF site (ICF, 1991). The PRA addressed potential impacts on human health and the environment associated with the landfill in the absence of remediation. The PRA was based on data previously collected at MLF site. Currently, a comprehensive work plan is being developed for the completion of a Baseline Risk Assessment for the MLF site. The results of the Baseline Risk Assessment will be evaluated in a subsequent operable unit decision document. The conclusions of the PRA relevant to the MLF Operable Unit One are as follows:

- The only potentially complete human exposure pathway under current land use conditions at MLF is the consumption of wildlife that has accumulated chemicals from the study area. Chlorinated pesticides

TABLE 6

MICHAELSVILLE LANDFILL GAS MONITORING
WELL SAMPLING RESULTS
FEBRUARY 1989

Gas Well	LEL Pentane (%)	CO_2 (%)	O_2 (%)	Total Hydrocarbons ppm (as Methane)
G1	1	0.5	19.5	200
G2	100	>6.0	3.0	--
G3	100	>6.0	3.0	--
G4	0	0.5	19.9	0
G5	0	0.04	20.4	1.2
G6	0	5.2	17.0	0
G7	0	0.08	20.4	1.2
G8	0	0.14	20.4	0
G9	100	>6.0	12.0	--
G10	100	4.2	17.0	--
G11	100	>6.0	18.0	--

G12[*]	100	5.0	15.0	--

<Footnote>
* Total hydrocarbon reading upwind 5 feet from the well was 0 to 10 ppm.
</footnote>

SOURCE: WES, 1990.

TABLE 7

MICHAELSVILLE LANDFILL GAS MONITORING
WELL SAMPLING RESULTS
MARCH 1989

Gas Well (%)	Methane (%)	Total Hydrocarbons (%)	Oxygen (%)	Nitrogen (%)	Carbon Dioxide
G1	0.00340	0.00340	20.6	78.9	0.5
G2	3.5	3.5	17.0	77.1	2.3
G3	40.0	40.0	8.2	31.3	20.5
G4	0.0002	0.0002	21.0	78.9	0.0760
G5	ND	ND	21.0	78.9	0.0380
G6	0.0026	0.0028	21.0	78.9	0.0550
G7	0.0004	0.0005	20.9	78.9	0.0900
G8	0.0047	0.0047	20.9	78.9	0.0410
G9	5.1	5.1	19.3	72.5	3.1
G10	0.28	0.29	20.8	78.3	0.46
G11	0.0950	0.0950	20.9	78.7	0.23
G12	0.18	0.19	20.9	78.6	0.17

ND = None Detected.

SOURCE: WES, 1990.

TABLE 8

MICHAELSVILLE LANDFILL GAS MONITORING
WELL SAMPLING RESULTS
APRIL 1989

Gas Well	Methane (%)	Total Hydrocarbons (%)	Oxygen (%)	Nitrogen (%)	Carbon Dioxide

(%)					
G1	0.0006	0.0010	20.9	79.0	0.13
G2	0.020	0.0200	13.1	78.7	8.20
G3	51.8	51.80	4.7	16.9	26.60
G4	0.0026	0.0026	21.0	78.9	0.05
G5	ND	ND	21.0	78.9	0.07
G6	ND	ND	21.0	78.0	0.04
G7	ND	ND	20.9	79.0	0.05
G8	0.0008	0.0008	21.0	79.0	0.04
G9	1.8	1.80	20.0	75.3	2.90
G10	23.7	23.70	11.8	46.2	18.30
G11	41.0	41.00	7.6	29.7	21.70
G12	0.040	0.0140	20.9	78.9	0.06

ND = None Detected.

SOURCE: WES, 1990.

and PCBs in surface water, soil and seeps at or near the landfill have the greatest tendency to bioaccumulate in organisms. The PRA noted that the potential for significant exposure from ingestion of game is low to moderate because the wildlife are expected to spend only a small portion of their total foraging time at MLF, seeps are intermittent, and ditches are unlikely to be significant sources of water for large game animals.

- Under future land use conditions, the ingestion, dermal contact and inhalation of ground water is a potential human exposure pathway that presents potential risks. Additionally, the evaluation of risks associated with the ingestion of ground water considered future pumping of off-site wells at a high rate because it could potentially result in withdrawal of ground water beneath MLF, although this scenario is highly unlikely. In the PRA, a set of chemicals of potential concern were selected for detailed evaluation based on the hydrogeologic assessment sampling results. The principal chemicals of concern found in the ground water were benzene, 1,1dichloroethene, 1,2-dichloroethane, PCB-1254, antimony, beryllium, cadmium, lead, mercury, nickel, selenium, thallium, chloride, iron, manganese, and total dissolved solids. The PRA then evaluated the potential human health risks associated with exposure to these chemicals of concern.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., 1x10[-4] or 1E-6). An excess lifetime cancer risk of 1x10[-6] indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. If the hazard index exceeds one (1.0), there may be concern for potential noncarcinogenic effects. As a rule, the greater the value of the hazard index above 1.0, the greater the level of concern.

In calculating the risks at the site, the exposures evaluated assume much more extensive contact with the site contaminants than is currently occurring, or is likely to occur in the future, and as such are very conservative.

The risks from MLF come from the unlikely but potential exposure to contaminated ground water and may be summarized as follows:

- Based on a review of chemical concentrations measured in

- ground water monitoring wells on-site, Federal drinking water standards were exceeded for the following chemicals (maximum detected concentrations are in parentheses): benzene (.0175 mg/L), 1,1-dichloroethene (.0216 mg/L), 1,2dichloroethane (.0092 mg/L), PCB-1254 (.0008 mg/L), antimony (.052 mg/L), beryllium (.008 mg/L), cadmium (.01 mg/L), lead (.024 mg/L),mercury (.007 mg/L), nickel (.140 mg/L), selenium (.061 mg/L), thallium (.011 mg/L), chloride (619 mg/L), iron (54.3 mg/L), manganese (24.6 mg/L), and total dissolved solids (1096 mg/L).

- The upperbound excess lifetime cancer risk for ingestion of shallow ground water is 2E-04, which is in excess of 1E-06, due primarily to beryllium. Table 9 presents the contaminants of concern, the cancer risks, and the hazard quotients (CDI:RfD ratio) reported in the PRA. The hazard index for shallow ground water is 4.0. The hazard index for deep ground water is 1.0.

- The risks presented for exposure to ground water provide an upper bound indication of potential future risks under the unlikely scenario in which future land use requires the highrate pumping of off-site wells, and in which no further ground water remediation is considered. Capping the landfill will significantly reduce the further migration of contaminants from the landfill, and the

Army's ground water remedial investigation will address additional ground water remediation needs.

. Some chlorinated pesticides present in surface water pose an increased risk of adverse acute and chronic effects in more sensitive aquatic invertebrates and insects at MLF. Furthermore, selenium, which has been found in ground water, could bioaccumulate through the food chain and adversely affect terrestrial wildlife such as sandpipers and raccoons. However, the PRA noted that because these species are not expected to spend large amounts of time in surface water bodies in the MLF area (suchas on-site ditches), the overall impact on the wildlife population is likely to be minimal. The Baseline Risk Assessment will quantify these impacts.

The risks summarized above are addressed by the remediation goals for MLF because the remediation goals serve to prevent contact with waste, while minimizing the migration of liquids through the landfill. Actual or threatened releases of hazardous substances from MLF, if not addressed by the Preferred Alternative or one of the other active measures considered, may present an imminent and substantial endangerment to public health, welfare or the environment.

VII. DESCRIPTION OF ALTERNATIVES

The general remedial action objectives for MLF are to: provide long-term minimization of migration of liquids through the landfill; ensure that the cover will function with minimal maintenance; promote drainage and minimize erosion or abrasion of the cover; accommodate settling and subsidence so that the cover's integrity is maintained; and provide adequate venting for any methane gases produced by the landfill wastes.

A number of remedial alternatives were developed to significantly reduce the risk to public health and the environment from exposure to and/or transport of contaminants that may be associated with surface water runoff or surface water infiltration and subsequent leachate generation at MLF. The Superfund law requires that each remedy selected to address contamination at a hazardous waste site be protective of human health and the environment, be cost effective, and be in accordance with statutory requirements.

The capping alternatives evaluated for MLF are summarized in Table 10. The excavation alternatives are summarized in Table 11. The costs for implementing each alternative include preliminary estimates of capital outlay and estimates for operation and maintenance (O&M), as well as present worthcosts.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The eight remedial action alternatives developed for MLF, as described in Tables 10 and 11, were evaluated by the Army using nine specific

evaluation criteria.

These nine criteria are:

Threshold Criteria

1) Overall protection of human health and the environment; and
2) Compliance with applicable or relevant and appropriate requirements.

Primary Balancing Criteria

3) Long-term effectiveness and permanence;
4) Reduction of toxicity, mobility, or volume through treatment;
5) Short-term effectiveness;
6) Implementability; and
7) Cost.

Modifying Criteria

8) State/support agency acceptance; and
9) Community acceptance.

The following sections present a brief discussion of each of the evaluation criteria and a comparative analysis of each of the alternatives based on the nine criteria.

Overall Protection of Human Health and the Environment

The criterion addresses whether or not a remedy will (1) clean up a site to within the risk range; (2) result in any unacceptable impacts; (3) control the inherent hazards (e.g., toxicity and mobility) associated with a site; and (4) minimize the short-term impacts associated with cleaning up the site.

The primary human health risk associated with the site is from exposure to and/or transport of contaminants that may be associated with surface water runoff or surface water infiltration and subsequent leachate generation at MLF.

The No-Action Alternative (Alternative 1) does not abate the risk of potential exposure to and/or transport of MLF contaminants. Therefore, Alternative 1 is not protective of human health and the environment and will not be discussed further.

Although the three excavation alternatives would all be protective of human health and the environment after implementation, each one would create additional exposure pathways during implementation. They cause an increased potential for human health exposure during the excavation of the waste, during which time local residents, APG workers, and site workers face an increased potential for inhalation of and dermal contact with the concentrated contaminants as they are disturbed, excavated, and perhaps released to the environment. In addition, the excavation process may create additional pathways for environmental degradation if materials are released during transport. Implementation of the excavation alternatives will create a risk to human health and the environment over a long period of time. Therefore, the excavation alternatives provide a low overall protectiveness of human health and the environment. Furthermore, the excavation alternatives are costly and currently, the contaminants from this site are not extremely mobile.

With respect to the Alternatives 2, 3, 4, and 5, Alternative 2 was determined to provide a moderate level of overall protectiveness; Alternative 3 was determined to provide a moderate to high level of overall protectiveness; and Alternatives 4 and 5 were determined to provide high levels of overall protectiveness. Alternative 2 would not provide the long-term effectiveness offered by Alternatives 3, 4, and 5 because no drainage layer is included. Alternative 3, in turn, is expected to be less effective than Alternatives 4 and 5 in the long term, because clay material is more permeable than geomembrane material and would thereby allow more infiltration of surface water into the landfill cap. Alternative 4 is considered to provide a slightly higher degree of overall protection than Alternative 5 because Alternative 4 provides both a clay layer and a geomembrane layer to prevent infiltration of surface water.

Compliance With ARARs

This criterion addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other environmental statutes and/or provide grounds for invoking a waiver.

A complete listing of all site-related action and location specific ARARs is presented in Table 12. Alternative 2 would fail to meet the MDE sanitary landfill closure requirements. Alternatives 3, 4, 5, 1A, 2A, and 3A would satisfy all ARARs. It should be noted that in August 1991, EPA and MDE determined that RCRA requirements for hazardous waste landfill closure would not have to be met by the MLF cap and cover system design because most of the materials disposed of in the landfill were domestic trash and other nonhazardous wastes from nonindustrial sources.

The implementation of any of the remedial action alternatives at MLF will impact 1.5 acres of emergent wetlands, 0.5 acres of wooded wetlands, and 0.25 acres of ponded area. To comply with the U.S. Army Corps of Engineers' Nationwide Permit Program authorized under CERCLA, 33 CFR 330,

Appendix A #38, the Army will replace the impacted wetlands by creating 1.5 acres of emergent wetlands, 1 acre of wooded wetland, and 0.25 acres of ponded area at the Romney Creek Wetlands Compensation/Mitigation Site. The Romney Creek Wetland Compensation/Mitigation Site concept plan is currently being developed with the assistance of the U.S. Army Corps of Engineers, Baltimore District.

Long-Term Effectiveness

This criterion refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

Alternative 2 would reduce the potential for future migration of contaminants from MLF by preventing the infiltration of surface water into the landfill, the discharge of seep water from the landfill, and the erosion of the landfill cover. However, the lack of a drainage layer in the conceptual design of this alternative increases the chances for future migration of contaminants over the long term. Proper construction and continued maintenance of the cap would be essential to help maintain the integrity of the cap design under Alternative 2.

Alternatives 3, 4, and 5 would significantly reduce the potential for future migration of contaminants from MLF by limiting surface water infiltration, seep discharges, and landfill cover erosion. These three alternatives would also provide a drainage layer, which is not included in Alternative 2. This drainage layer would help promote the drainage of surface water and limit ponding and infiltration through the landfill cap material. Although future migration of contaminants could occur with Alternatives 3, 4, and 5 because the buried waste would be left in place and the cap integrity could diminish over time, proper construction and continued maintenance of the cap would serve to maintain the integrity of the cap under these alternatives.

In comparing Alternatives 3, 4, and 5, Alternative 4 is expected to provide a slightly higher degree of long-term effectiveness than Alternatives 3 and 5 because both a geomembrane liner and a clay layer are included in the conceptual design of Alternative 4. Alternative 3, in turn, is expected to provide less protection against long-term infiltration through the cap than Alternative 5 because the clay material is more permeable than the synthetic liner.

Alternative 1A (excavating and hauling the waste off-site) provides the highest level of long-term effectiveness on-site because the source is removed. However, the source is not destroyed but transferred to another location, and continues to carry long-term liability. Alternative 2A (excavating and incinerating the waste) also has a high level of long-term effectiveness because it involves removing and destroying the source. However, approximately 25% of the volume of the waste material will remain as ash and require landfilling at the site. Although the ash can be stabilized, the stabilization process is not permanent and the ash will eventually break down and potentially release concentrated contaminants to the environment. Alternative 3A (excavating the waste, lining the cavity, replacing the waste, and capping the landfill) has a moderate to high level of effectiveness because it involves isolating the waste and preventing infiltration like the other capping alternatives. In addition, this alternative also provides the added protection of a liner beneath the waste. However, the waste will still remain in place.

Reduction of Toxicity, Mobility, and Volume

This criterion refers to the anticipated performance of the treatment technologies that may be employed in a remedy.

Alternatives 2, 3, 4 and 5 would serve to reduce the mobility of contaminants present in MLF by reducing infiltration, leachate generation, andcontaminant migration. Alternative 4 is expected to reduce infiltration, leachate generation, and contaminant migration more effectively than the three other containment alternatives because both a clay layer and a geosynthetic membrane are used. Alternatives 3, 4, and 5 are expected to reduce infiltration, leachate generation, and contaminant migration more effectively than Alternative 2, in which the lack of a drainage layer could make the landfill cap more susceptible to these problems in the long term.

Alternative 5 could be slightly more effective than Alternative 3 in reducing infiltration, leachate generation, and contaminant migration because the geosynthetic membrane associated with Alternative 5 is expected to be less permeable than the clay layer associated with Alternative 3.

Alternative 1A would reduce the volume of the waste by removing the source to another location. The toxicity and mobility of contaminants would be minimized at the site because the waste would be removed. However, the toxicity of the contaminants transferred to another location would remain the same even though the mobility would be reduced in a secure landfill. Alternative 2A would reduce the volume, mobility, and toxicity of the contaminants by removing the waste from the site and destroying it by incineration. However, 25% of the waste volume would remain as ash and the toxicity and mobility of the ash would be reduced only over the short-term by stabilization. Even after the ash is stabilized and replaced on-site the ash will degrade and mobilize contaminants after some period of time. Alternative 3A will not affect the volume or toxicity of the waste, although the lined excavation will reduce the mobility.

Short-Term Effectiveness

This criterion refers to the period of time needed to achieve protection, and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals have been achieved.

Alternatives 2, 3, 4, and 5 are expected to take about the same amount of time (10 to 14 months) to implement. The limited potential for exposure of workers to site contaminants under Alternatives 2, 3, 4, and 5 could be controlled with proper personal protective equipment, spraying of work areas with water to minimize dust generation, and appropriate training. A temporary silt fence would be used during construction to minimize any transport of contaminants via surface water runoff. Therefore, all four containment alternatives are expected to provide adequate short-term effectiveness.

The three excavation alternatives provide a low level of short-term effectiveness because the waste will be disturbed during excavation. During excavation, there is a significant potential for worker exposure to contaminants and hazards, a potential for further environmental exposure to contaminants during transport, and a potential for significant airborne dispersion of contaminants. Although health and safety controls can be used to reduce the potential effects, the risk to human health and the environment during excavation would be significant.

Implementability

This criterion describes the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

Alternatives 2, 3, 4 and 5 are technically feasible. Alternative 2 would be easiest to implement because the design requirements for the cap and cover system would be the least complex. Alternatives 3, 4, and 5 are expected to be somewhat more difficult to implement than Alternative 2 because the design considerations are slightly more complex. There does not appear to be a significant difference in implementation considerations amongAlternatives 3, 4, and 5.

Alternatives 3, 4, and 5 are expected to be acceptable to regulatory agencies because all would meet ARARs. Alternative 4 could have a slight advantage over Alternatives 3 and 5 because, in the future, regulatory agencies might determine that compliance with RCRA design requirements for the cap and cover system is necessary. Alternative 2 would be the capping alternative least acceptable to the regulatory agencies because it would not meet all ARARs. Thus, Alternatives 3, 4 and 5 all have an advantage over Alternative 2. Alternative 4 has a slight advantage over Alternatives 3 and 5 in terms of administrative feasibility.

The three excavation alternatives will be difficult to implement. Alternative 1A is difficult to implement because of the large volume of waste which must be excavated, hauled off-site, and placed in a secure landfill. The volume is so large that there is a possibility that existing landfills would not have the capacity to accept the waste and a new landfill would have to be constructed to accommodate the waste. Alternatives 2A and 3A are also difficult to implement, again due to the large volume of waste. For this volume of waste, the incineration process proposed in Alternative 2A would require more than 8 years to complete.

Cost

This criterion addresses the capital for materials, equipment, etc., and the O&M costs.

Excavation alternative costs are two to twenty times as much as the capping alternative costs. Assuming a Present Worth Cost which includes 30 years of O&M costs, Alternative 2A is the most expensive excavation alternative with a Present Worth Cost of $182,795,000. Alternative 1A is the next most expensive excavation alternative with a Present Worth Cost of $135,520,000. Alternative 3A is the least costly excavation alternative with a Present Worth Cost of $21,825,000. Alternative 4 would be the most expensive capping alternative to implement with a Present Worth Cost of $10,001,000. Alternative 2 would be the least expensive to implement with a Present Worth Cost of $7,442,400. However, as discussed above, Alternative 2 would not meet MDE sanitary landfill closure requirements. Alternatives 3 and 5 have Present Worth Costs of $9,616,600 and $9,207,200, respectively. Therefore, Alternative 5 is the most cost-effective remedy which meets all ARARs.

The Army has selected Alternative 5 for the remediation of MLF. Alternative 5 offers a cost-effective cap and cover system while providing adequate protection of human health and the environment.

Support Agency Acceptance

This criterion indicates whether, based on their review of the RI, FFS, Proposed Plan, and the ROD, the support agencies concur with, oppose, or have no comment on the Selected Remedy.

EPA and MDE concur with the Selected Remedy.

Community Acceptance

This criterion assesses the public comments received on the RI, FFS, and Proposed Plan.

A public meeting was held on April 9, 1992, at the Aberdeen Area Chapel, APG. This meeting lasted approximately 2 hours, and the members of the public in attendance were able to have all of their questions about the site answered. Written comments were received during the public comment period. The major concerns of the community involved the protection of ground water. The Responsiveness Summary which is included in this ROD responds to all written public comments received.

IX. DESCRIPTION OF THE SELECTED REMEDY

Based upon the requirements of CERCLA and the detailed evaluation of the alternatives, the Army has determined that Alternative 5, Installing a New Cap in Accordance with MDE Requirements for Sanitary Landfill Closure Using a Geosynthetic Membrane, is the most appropriate remedial alternative for MLF Operable Unit One at Aberdeen Proving Ground, Maryland and is therefore the Selected Remedy.

The Selected Remedy involves the installation of a new, multilayered cap in accordance with MDE requirements for Sanitary Landfill Closure (COMAR 26.04.07-21). The design features of this capping system shall include:

- Compacted semipervious earthen material (minimum 2 feet thick) over the entire landfill area;

- Regrading material to provide a minimum of 4 percent slopes over the landfill;

- A geosynthetic membrane with a minimum thickness of 20 mil and maximum permeability of $1x10^{-10}$ cm/s as the impermeable layer;

- A sand drainage layer with an in-place permeability greater than $1x10^{-3}$ cm/s and minimum thickness of 1 foot (which would include a network of drainage pipes to promote stormwater drainage);

- Final earthen cover (minimum 2 feet thick) with vegetative stabilization; and

- Gas venting.

Figure 6 provides an illustration of a typical cross-section for the Selected Remedy. Table 13 provides a detailed breakdown of the costs

associated with it. Some changes may be made to the Selected Remedy as a result of the remedial design and construction processes. In general, such changes will reflect modifications resulting from the engineering design process.

As discussed previously in this ROD, the geosynthetic membrane and the sand drainage layer shall be designed, inspected, and maintained to achieve permeabilities of no more than 1x10[-10] cm/sec and 1x10[-3] cm/sec respectively. During the design of the cap, an O&M manual will be developed. At a minimum the manual shall include provisions for repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, etc., the cultivation of natural vegetation (grasses and weeds) on the topsoil to prevent erosion, and 5-year reviews under Section 121(c) of CERCLA, 42 U.S.C. 9621 (c), because the Selected Remedy will result in contaminants remaining on-site.

X. STATUTORY DETERMINATIONS

The Army's responsibility under the FFA is to implement remedial actions which will protect human health and the environment. Section 121 of CERCLA, 42 U.S.C. 9621, also establishes several other statutory requirements and preferences. The Selected Remedy must be cost effective, utilize a permanent solution and implement alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The Selected Remedy must comply with all applicable or relevant and appropriate requirements set forth by State and Federal environmental regulations, unless such requirements are waived in accordance with CERCLA Section 121, 42 U.S.C. 9621. Finally, the Army must attempt to satisfy the statutory preference for remedial actions that permanently reduce the toxicity, mobility, and volume of the siterelated wastes. The following sections discuss how the Selected Remedy meets the statutory requirements and preferences set forth by Section 121 of CERCLA.

Protection of Human Health and the Environment

The risk posed by MLF and addressed in this ROD is potential exposure to and/or transport of contaminants that may be associated with surface water runoff or surface water infiltration and subsequent leachate generation. The Selected Remedy will eliminate this risk by covering the buried MLF waste material with a capping system designed to prevent surface water infiltration and/or contact with potential contaminants. Exposure levels will be reduced to within the 10[-4] to 10[-7] range within which EPA manages carcinogenic risk and the Hazard Indices for noncarcinogens will be less than one. Implementation of the Selected Remedy is not expected to result in any adverse short-term risks or cross-media impacts.

Compliance With Applicable or Relevant and Appropriate Requirements

The Selected Remedy will comply with all the ARARs in Table 14. No ARAR waivers will be used. Table 14 is organized according to action-specific and location-specific ARARs. There are no chemical-specific ARARs relevant to this remedy.

Cost-Effectiveness

The Selected Remedy provides a level of overall effectiveness comparable to or greater than that provided by other remedies at the lowest cost.

The estimated Present Worth Cost of the Selected Remedy is $9,207,200, which includes 30 years of O&M at the site. The O&M activity is expected to include routine inspections of the cost cutting and maintaining the vegetation on the cap, and minor repairs to the cap to ensure its long-term effectiveness.

Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable (MEP)

The Army has determined that the Selected Remedy represents the maximum extent to which permanent treatment technologies can be utilized in acost-effective manner for remediation of MLF.

Of the alternatives that comply with ARARs, the most permanent solution would be to remove the source from the site and place the waste in a secure landfill. The other capping and excavation alternatives would provide adequate long-term effectiveness and permanence, but the capping alternative would not address the potential for continued migration of contaminants to the water table, Alternative 2A would not address the potential for degraded ash material to leach contaminants, and Alternative 3A would not address the potential for the lined landfill to leak over time.

The capping alternatives and Alternative 3A would reduce mobility of contaminants at the site, but would not reduce toxicity or volume because the wastes remain on-site. Alternative 1A would remove the waste from the site, thus providing the greatest reduction of toxicity, mobility, and volume. However, the liability for the waste is merely transferred to another location under this alternative. Alternative 3A would reduce the volume, but does not address the potential for degraded ash to leach contaminants to the water table over time.

The capping alternatives provide a much greater level of short-term effectiveness than the excavation alternatives because the waste would remain in place and would not pose an increased threat to human health or the environment during excavation activities.

The capping alternatives and Alternative 3A would be more easily implemented than Alternatives 1A and 2A. Alternative 1A would require finding an enormous volume of secure landfill capacity, while Alternative 2A would require a great deal of time to implement.

The capping alternatives are much less costly than the excavation alternatives. Of the capping alternatives, Alternative 5 is the most cost effective.

Of the five primary balancing criteria discussed immediately above, the first two (long-term effectiveness and permanence and reduction of toxicity, mobility, or volume) were relatively equal among the capping and excavation alternatives, and therefore, offered little comparative information upon which to base a decision. The short-term effectiveness, implementability, and cost criteria, however, afforded sufficient contrast among the alternatives to facilitate a clear decision. The Selected Remedy will provide a high level of short-term effectiveness and a high level of implementability at a lower cost. The community accepted this selection based on the issues of short-term effectiveness and implementability. EPA and MDE support the Selected Remedy.

Preference for Treatment as a Principal Element

None of the capping alternatives considered for the MLF site employ treatment because no treatment technologies are currently available that would eliminate the risks and associated with MLF in a cost-effective manner. The Selected Remedy is the most cost-effective and technically feasible approach to eliminate site risks.

This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. The size of the landfill, excessive costs associated with the excavation alternatives, and the difficulties of implementing the excavation alternatives preclude a remedy in which contaminants could be excavated and treated effectively. The Selected Remedy is consistent with the Superfund program policy of containment, rather than treatment, for wastesthat do not represent a principal threat at the site and are not highly toxic or mobile in the environment.

Documentation of Significant Changes

The Proposed Plan for MLF was released for public comment in March 1992. The Proposed Plan identified Alternative 5, Installing a New Cap in Accordance with MDE Requirements for Sanitary Landfill Closure Using a Geosynthetic Membrane, as the preferred alternative. The Army reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the Selected Remedy, as it was originally identified in the Proposed Plan, were necessary.

XI. RESPONSIVENESS SUMMARY

From March 18, 1992 to May 4, 1992, EPA held a public comment period on the HGA, the FFS, and the Proposed Plan for the MLF in the Aberdeen Area of APG. A public meeting on the Proposed Plan was held on April 9, 1992, the transcript of which is part of the Administrative Record for this site. This responsiveness summary summarizes comments on the Proposed Plan by interested parties and provides the Army's responses to the comments.

This responsiveness summary is divided into the following sections:

- Overview
- Background on Community Involvement
- Summary of Comments Received during Public Comment Period and Agency Responses
- Remaining Concerns

Overview

At the time of the public comment period, the Army had already endorsed a Preferred Alternative for MLF. EPA and MDE concurred on the Army's recommended capping alternative to prevent precipitation from infiltrating thewaste and subsequently mobilizing contaminants which can leach to the ground water. The Preferred Alternative specified in the Record of Decision (ROD) consists of the following:

- Installing a new, multilayered cap in accordance with MDE requirements for sanitary landfill, using a geosynthetic membrane. The design features of this system include a minimum 2 feet of compacted earthen material over the existing landfill cover; a geosynthetic membrane (minimum thickness 20 mil) over the earthen material; 12 inches of sand drainage material imbedded with perforated drainage pipes over the membrane; and a final earthen cover (minimum 2 feet thick) with a 4 percent minimum slope and vegetative stabilization.